Digitalising Europe's aviation infrastructure

A discussion paper

8 November 2017

SESAR
JOINT UNDERTAKING
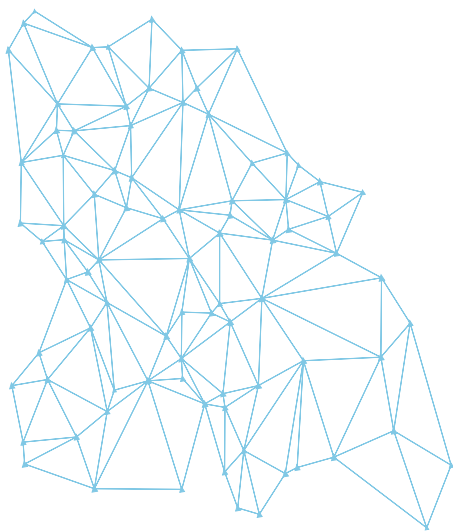
Purpose of this discussion paper

This paper was prepared within the context of European ATM Master Plan 2018 update campaign in order to prompt discussions among European aviation stakeholders on the digital transformation of the sector. The paper makes use of recent EU and global studies on digitalisation in aviation, taking into account challenges and trends, and the value at stake for the European economy.

The paper summarises questions that will need to be answered, as well as actions to be taken in order to move forward with the transformation process. This short paper is only the starting point for a much more in-depth stakeholder-wide consultation on the modernisation of European air traffic management (ATM). The results of this consultation will be published in the fourth edition of the European ATM Master Plan (December 2018).

1.   The story so far

50 years ago European leaders anticipated that the development of commercial aviation was about to literally take off and to change the world forever. With it would come new opportunities and challenges requiring individual States to go beyond their own national interests and to team up on very strategic and ambitious decisions. Seeing the big picture, these leaders decided to bring together the brightest minds from across the continent to build extraordinary aircraft and gradually the tools and operating environment to make them fly. Thanks to these pioneers, aviation is today the lifeblood of our economy, the key to mobility in Europe and a driver of connectivity with the rest of the world.

But the world of aviation is changing, starting with the aircraft itself. In the not-so-distant future, air vehicles are set to become more autonomous, more connected, more intelligent. That's not all: there will be all sorts of new vehicles, drones or should we call them "robots with wings". These vehicles will be claiming their share of the skies. The services relating to the transport of passengers or goods are evolving too. Tomorrow's passengers will not make choices based on loyalty to any one airline, but primarily on their mobility needs. They expect to get from A to B, door to door seamlessly and efficiently.
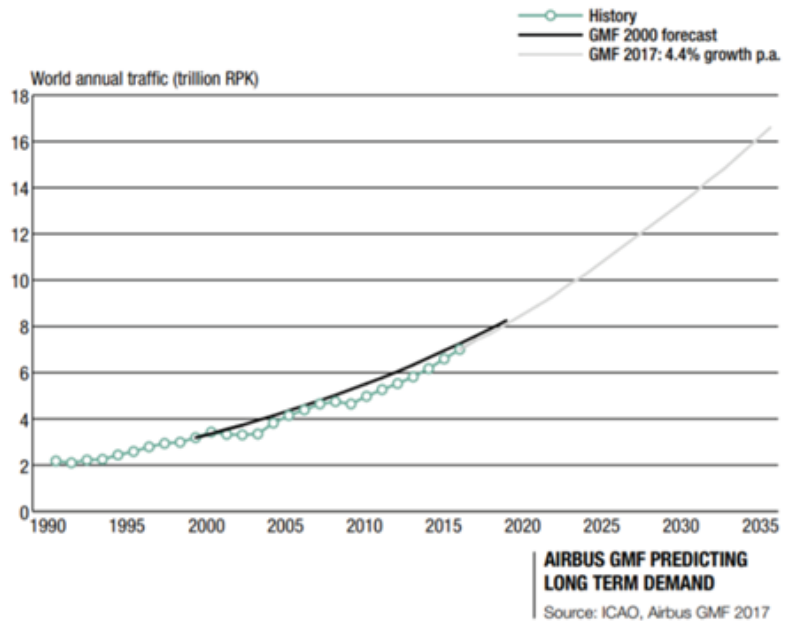
The underlying aviation infrastructure and its future operations capabilities, collectively known as the air traffic management system, will evolve just like the rest of the air transport and aviation value chain. Of course, this will be driven by increased demand, but as well by technology becoming available e.g. internet of things, big data, artificial intelligence and quantum computing. The transformation to this new era in flying presents many opportunities but also challenges for the European aviation industry.
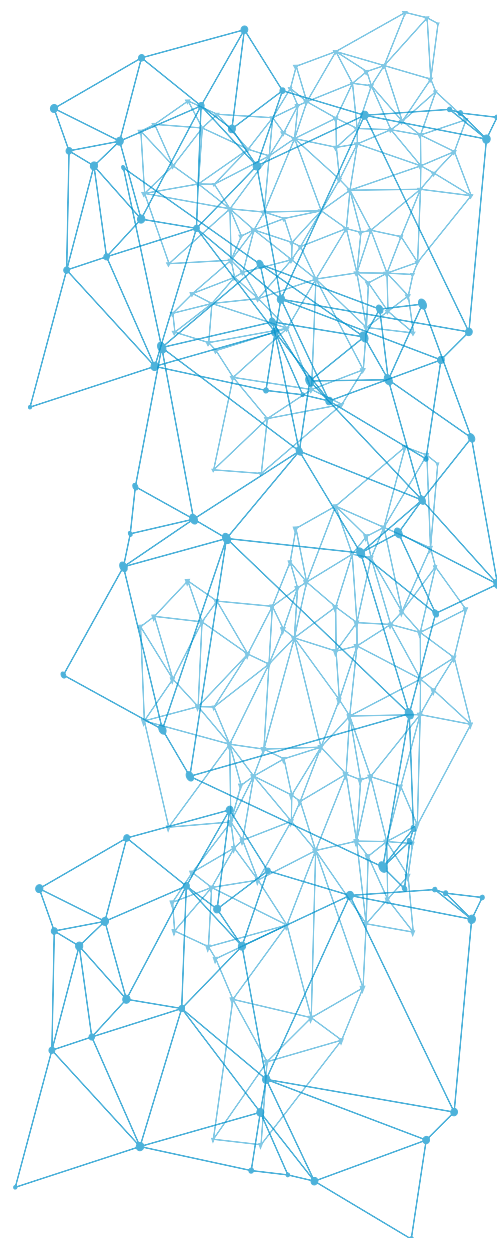
2. Opportunities and challenges towards 2050

AIR TRAFFIC GROWTH

On average, global air traffic doubles every 15 years, and is expected to continue its natural growth reaching up to 4 times its current level by 2050 [1]. Air traffic management will need to adapt to this increased traffic and the move from thousands of conventional aircraft in the sky every day to potentially hundreds of thousands of highly connected and automated air vehicles/devices, offering advanced data-driven services and operating in all environments.

World annual traffic (trillion RPK)

History
GMF 2000 forecast
GMF 2017: 4.4% growth p.a.

AIRBUS GMF PREDICTING LONG TERM DEMAND
Source: ICAO, Airbus GMF 2017

URBAN MOBILITY AND CREATION OF NEW MARKETS

In the future, two-thirds of the global population will reside in urban areas, which will foster the creation of mega cities with an increasing need for transportation within and between them. This growth opens up possibilities for European aviation players or new entrants to create markets, such as urban mobility, with drones in particular positioned to provide new services across industries. New infrastructure (e.g. new airport models, traffic management systems for drones, communication and network technologies) and the appropriate level of regulation will be needed to support these new markets.

TECHNOLOGICAL DISRUPTION

The top five companies in the world today are digital platforms. With their access to financial capital and skilled people, these companies have become innovation frontrunners, along with an emerging ecosystem of tech start-ups, in advanced technologies that are now overlapping with traditional aviation. And it is these advanced technologies (Big data/automation/artificial intelligence /connectivity/smart devices/Internet of things/autonomous vehicles/augment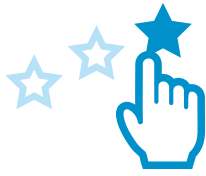ed reality/virtual reality…) that are revolutionising the business landscape. European aviation needs to embrace this change and engage in its digital transformation based on data, connectivity and automation.
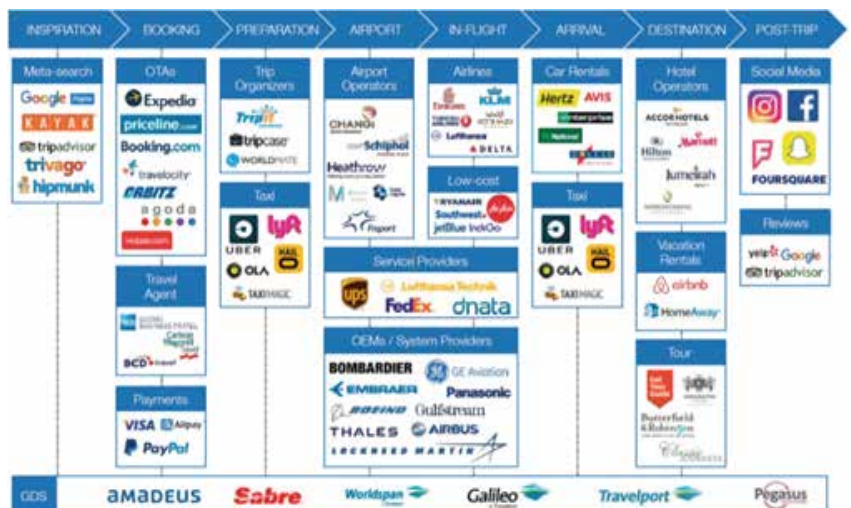
Source: World Economic Forum/Accenture analysis

HIGH CUSTOMER EXPECTATIONS

The expectations of a sophisticated customer base living in smart mega-cities will be reshaped by hyper or 'always-on' connectivity, and personalisation stemming from data-driven customer insights and the imperative to save increasingly valuable time. Connectivity and innovation are driven by tech actors setting new standards in all industries (e.g. retail, broadcasting, automotive, consumer goods), raising the bar of customer expectations and adding impetus for digital transformation within traditional industries. Traditional business and leisure travel will be transformed by travelling on demand and door-to-door service capabilities.

SAFETY AND SECURITY

As the number of manned aircraft and drones grow, the future infrastructure needs to provide robust enablers for ensuring collision avoidance and safety. Equally, with the digital transformation will come increased connectivity and data sharing, which will open the system up to cyber threats. Mitigating cyber security risks in systems will require the establishment of a sustainable framework in which high-level security requirements in each of the technological solutions are defined. At the same time an integrated operational and technical architectural approach is required, leading to increased operational resilience against cyber attacks. There will also be a need to address the privacy, data protection and other societal challenges that will result from this digital transformation.

AUTOMATION

The recent and rapid evolution of automation beyond routine work and its expansion (in combination with artificial intelligence) into machine learning and mobile robotics have opened new business opportunities in many industries. A recent analysis of the aerospace, airline and logistics sectors suggests the move toward pilotless aircraft represents a EUR 30 billion (USD 35 billion) global opportunity, including EUR 2.6 billion (USD 3 billion) in savings in the business aviation sector, and could technically be ready for commercial operations by 2025 [2]. Digital transformation demands a different skill set from workers in today's economy, and will create new types of jobs. Challenges such as balancing automation and the human factor, and reskilling the workforce for the digital economy will need to be tackled collaboratively by industry, regulators and policy-makers [3].

EUR 850 m
(USD 1.1 bn)
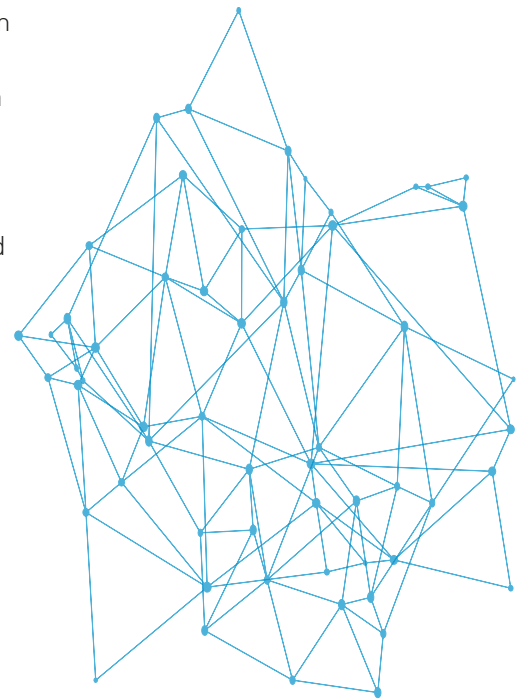Amount Google alone has invested in autonomous technologies

GLOBAL COMPETITION

Europe is not alone in its efforts to generate value from digitalisation. The United States (US), South Korea, Japan and China are significantly investing into technology and innovative businesses. For instance, the US is the leader in producing defence drone systems – followed by Israel – while China is the leader in producing leisure units that are increasingly used for professional purposes.
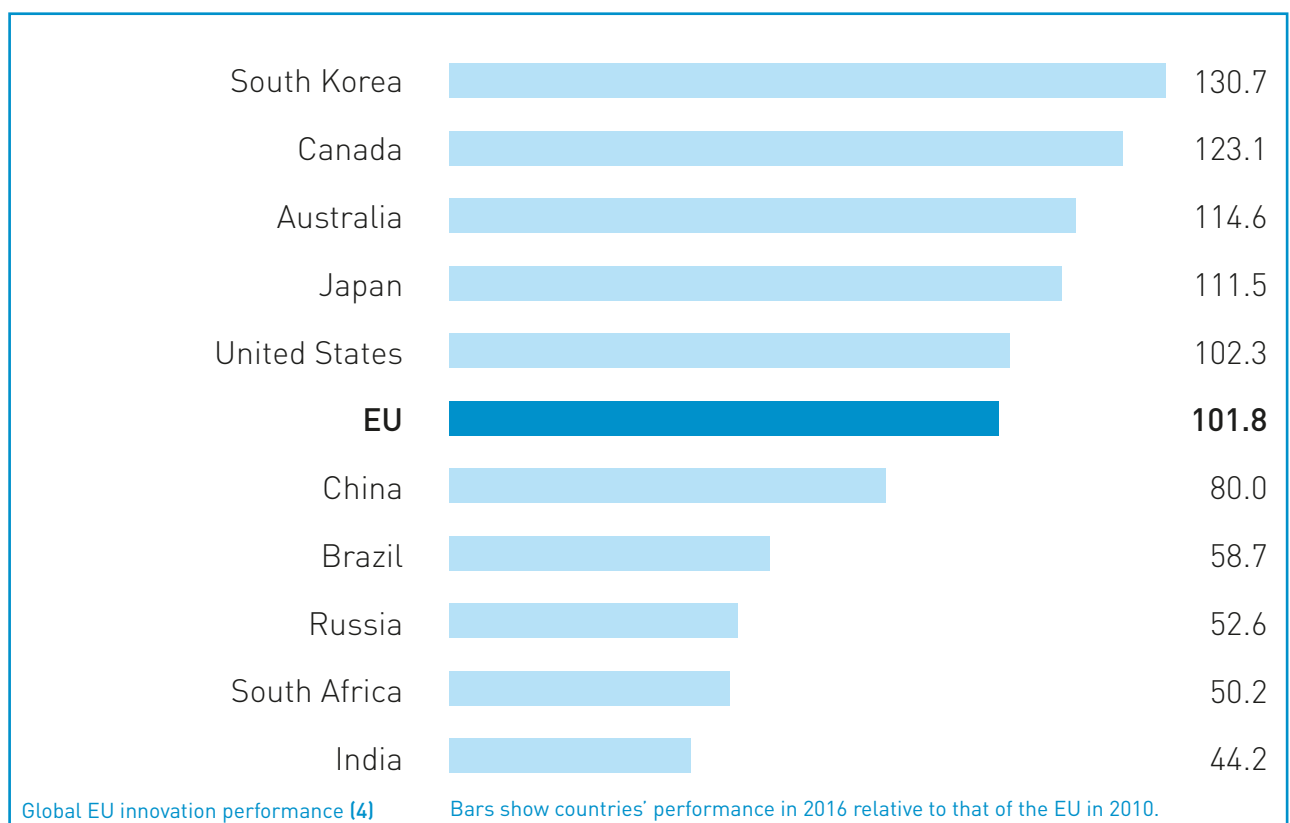
The EU Innovation Scoreboard report [4] shows that while the innovation performance of the EU is improving, progress must accelerate. Many of our global competitors are increasing their innovation performance at a much faster pace, and within the EU, performance gaps must be addressed.

In addition, global growth implies a reduction in Europe's share of world population from ~10 % today to ~7 % in 2050 and growing geopolitical powers (China will have surpassed US as largest nation in terms of GDP, with India ranking in the top three) will challenge European market share and leadership in the aviation industry. An aging Europe with expected productivity gap and a lack of scale may struggle to keep pace with global competition.

GLOBAL EU INNOVATION PERFORMANCE

Country	Performance
South Korea	130.7
Canada	123.1
Australia	114.6
Japan	111.5
United States	102.3
EU	**101.8**
China	80.0
Brazil	58.7
Russia	52.6
South Africa	50.2
India	44.2

Global EU innovation performance (4)   Bars show countries' performance in 2016 relative to that of the EU in 2010.

3. Value at stake

The next 10 years will be a critical period to pave the way for the digital transformation of aviation. Analysis [3] suggests that over the next decade (2016 to 2025), digitalisation in aviation, travel and tourism is expected to:

- Create up to EUR 260 billion (USD 305 billion) of value for the industry through increased profitability;
- Migrate EUR 85 billion (USD 100 billion) of value from traditional players to new competitors;
- Generate benefits valued at EUR 600 billion (USD 700 billion) for customers and wider society through a reduced environmental footprint, improved safety and security, and cost and time savings for consumers;
- Result in a net displacement of current jobs in the industry, which is expected to be partially offset by the creation of next-generation skilled jobs inside and outside the travel ecosystem.

Air traffic management and aviation's infrastructure will play an essential role in this process, as they will have to adapt in order to cater for the aforementioned growth in traffic and diversity of air vehicles in the sky. Initial analysis suggests that with a digitalised infrastructure, the industry could directly unlock around EUR 30 billion per annum by 2050 (5). This estimate builds on optimisation efforts already covered in the current SESAR vision – but with a step change in the ambition to integrate new digital solutions and services and push further technological boundaries. The data suggests that having an advanced digital infrastructure will be key to enhancing capacity (both airspace capacity and airport capacity), increasing operational efficiency, reducing costs, delays and enabling new services (e.g. drone-based, mobility, shared-economy and peer-to-peer services). In addition to unlocking this value, a digital infrastructure could also provide a significant contribution to European citizens' well-being, while strengthening security and fostering positive spill-over effects, such as saving time for travelers or reducing CO_2 emissions.
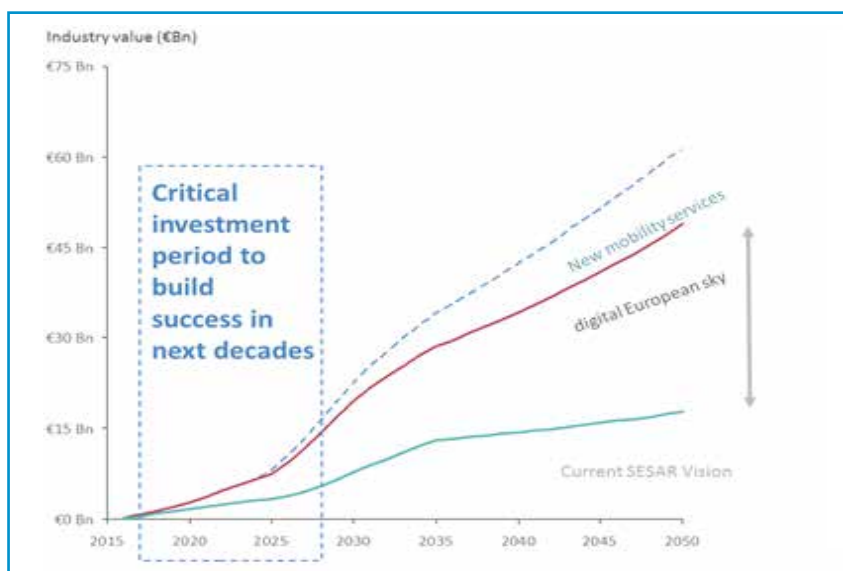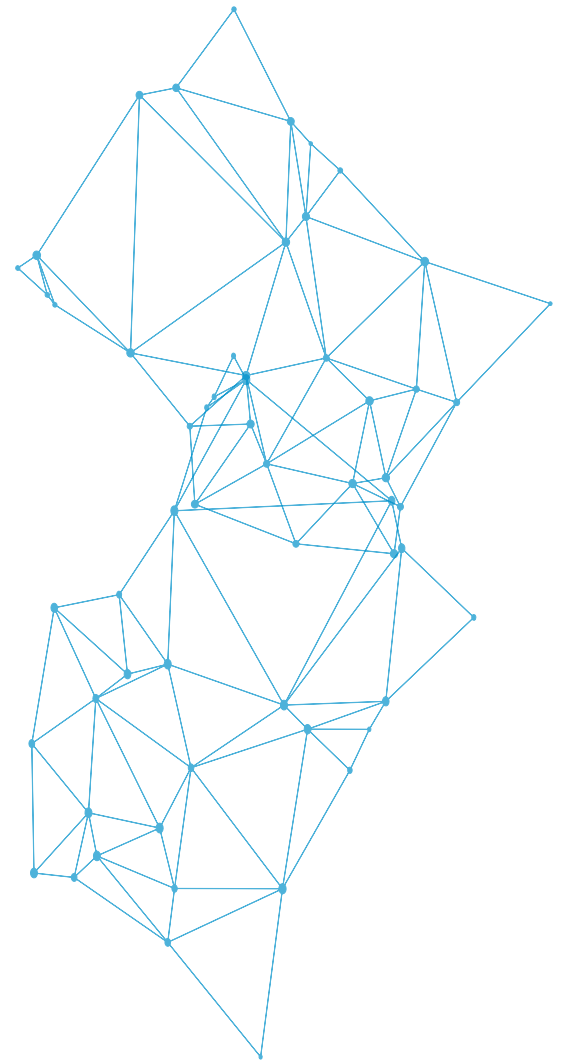
Infrastructure to directly unlock

EUR 30 Billion per annum in 2050

4. Steps to unlocking aviation's digital value

It is widely recognised [3] that maximising the value of digitalisation in aviation, travel and tourism will require concerted action from industry leaders, regulators and policy-makers. No single company or country can unlock this value and address these challenges alone as the infrastructure is shared and needs to rely on homogeneous standards to foster innovation. It is therefore critical to boost the level of cooperation between industry, academia, and innovative players to bring together the physical and digital world and build a sand box for innovation. This will support continued European leadership in global aviation consistent with the EU Aviation Strategy [6], and ensure the necessary skills of tomorrow are developed and available within Europe.

To make digital transformation a reality, there are a number of challenges that stakeholders must address, namely how to:

- Transform legacy systems into agile interoperable platforms, to enable secure plug-and-play interactions between partners in the ecosystem;
- Enable educational institutions to design curricula that prepare the next generation for the digital economy;
- Develop a multi-stakeholder approach – involving private, public and civil-society organisations – to deliver enabling frameworks that define the appropriate uses of data.

An important means to ensuring that digitalisation is mapped out, developed and effectively deployed will be through the European ATM Master Plan. The 2015 edition flagged this digital shift, referencing the aspirations of the EU Aviation Strategy and Flightpath 2050 [7]. The 2018 edition will bring together aviation stakeholders for a 12-month consultation to identify the key innovation activities needed for future-proofing Europe's ATM for the digital era under the umbrella of the EU Aviation Strategy.
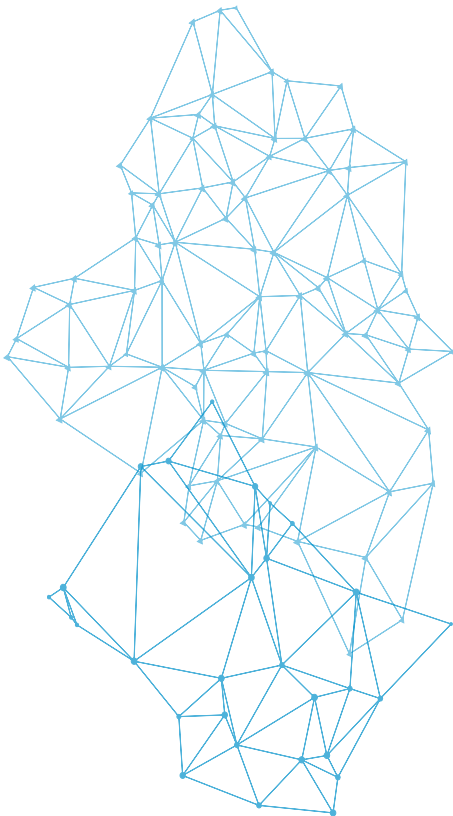
5. References

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[2] UBS—"Flying solo —how far are we down the path towards pilotless planes?"

[3] World Economic Forum White Paper "Digital Transformation Initiative Aviation, Travel and Tourism Industry And this the second" january2017
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